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ARTICLE VI.

On the Corpus Luteum. By Ch. D. Meigs, M.D., Mem. Am. Phil. Soc., Prof. of Mid. and Diseases of Women and Children in Jefferson Med. Coll. Read January 15th, 1847.

ON the 18th of December, 1846, I made a verbal communication to the Society, setting forth certain opinions I had formed as to a vitellary nature of the Corpus Luteum.

I now propose to lay before the Society, in a more formal manner, and in larger detail, the proofs, as I suppose them to be, of my proposition, with certain arguments, to show how a reasoning upon the subject tends to confirm the opinions derived from observation. I request that the present communication may be considered as a repetition and enlargement of the statements I have already made here, on the subject in question.

Since the date referred to I have carefully made researches both with my Chevallier's microscope and by other methods, as to the comparative appearances of vitellary matter taken from the egg, and matter procured from fresh Corpora Lutea.

These renewed researches leave me very fully convinced that the yelk of eggs and the yellow matter found in a corpus luteum, are of the same apparent structure, form, colour, odour, coagulability, and refractive power.

Having placed a small quantity of yelk on the platine, and just before I have brought the object into the focus I have been struck with the appearance of the transmitted light; a bright-yellow, which fills the whole tube of the instrument.

When I have, in like manner, placed a bit of fresh corpus luteum, of the cow or sheep, on the compressor, and have crushed it, by turning the screw, I have found the tube filled with the same tinted light, before obtaining the focus.

A portion of yelk placed beneath the objective, exhibits numerous granules, corpuscles containing a yellow fluid, and oil-globules, mixed with a quantity of punctiform bodies.

Upon turning the screw of the compressor on a small lump of corpus luteum, carefully dissected out from its indusium, there is seen to escape from the crushed mass a quantity of granules, corpuscles filled with yellow fluid, oil-globules, and punctiform bodies swimming in a pellucid liquor.

The appearances observed upon examining a portion of yelk and a portion of corpus luteum are so similar that it would be difficult, I think, to discriminate between them, but for the exception, that along with the vitellary corpuscles and granules and globules of the yellow body, there will be found flocks of laminated cellular tela, blood-discs, and other detritus of the organ, destroyed by the compressor.

The transparent corpuscles transmit a yellow light, whether observed singly, or in clusters, or acervuli.

The same is true of the corpuscles of the yelk.

On crushing a bit of corpus luteum with the compressorium, there escapes much granular matter that accurately resembles the granules of the granular membrane, the proligerous disc or retacula of the Graafian follicle. This is the case when great precaution has been used in procuring the bit from the outer superficies of the corpus luteum; avoiding to take any portion that might have touched the inner superficies of the crypt left by the escape of the ovulum.

The similarity in the appearance leads me to suppose an identity of nature and origin.

I think no person accustomed to the use of the microscope could detect any difference between the molecules pressed out of a bit of corpus luteum, and those that escape from a crushed mammiferous ovule, or the yelk of an egg, excepting the debris or detritus before mentioned, and which is referrible to the destructive power of the compressorium.

I have so many times examined the mammiferous ovulum that I suppose myself quite competent to compare its contents with those of the corpus luteum, and with common yelk.

I hope I am entitled to say, that the colouring matter and the chief constituent bulk of a corpus luteum, is a true vitellary matter, deposited outside of the inner concentric spherule, or ovisac of the Graafian follicle.

For the proof of the truth of this opinion I refer to the future observations of the micrographers, who will be able to confirm or to confute my statement.

There is not, so far as I know, any author who has taken this view of the constitution of the corpus luteum—though that substance has been the fruitful topic of elaborate research and hypothesis, owing to the interest connected with its being, both in a physiological and medico-legal relation.

Previous to the year 1825, when John Evangelista Purkinje, of Breslau, discovered the germinal vesicle of the unfœcundated egg; to the year 1827, when Ch. Ern. V. Baer detected the mammal ovum, with its germinal vesicle; and the year 1830, when Rudolph Wagner ascertained the existence of the *Keim fleck*, or macula germinativa, all notions and opinions on the mammal ovum may be set down as naught—since the opinions of the learned are now based on the discoveries just mentioned; which have led on a complete revolution in many most important relations of physiological action, and therapeutical indication and treatment.

It would be bootless, therefore, to ask what the writers of an earlier date than 1825, may have supposed upon this subject.

Dr. Carpenter, John Müller, Thomas Schwann, Heule, and Huschke have not hinted at the vitellary nature of the yellow body.

Dr. Henle, in his *Allgemeine Anatomie*, says, so weiss mann namentlich, wie die Gräfschen Bläschen in folge der congestion welche den fruchtbaren beischlaf folgt, erst anschwellen und den platzen, wahrend sie zugleich von Blut angefüllt werden, welches sie almahlig entfarbt, organisirt, und in eine narbensubstanz verwandelt, die zuleszt verschwindet.—P. 894.

In this paragraph, Dr. Henle attributes the swelling and the bursting of the Graafian follicle to the congestion attending a fœcundation. He says the ruptured cell is filled with blood, which colours it, becomes organized, converted into a scar-like substance, and then, at length, disappears.

Dr. Huschke, in his *Treatise on Splanchnology*, elaborately details the opinions of authors on the corpus luteum; but no where alludes to the vitellary nature of that body.

Dr. Gendrin, M. Maygrier, Dr. Robert Lee, Wharton Jones, M. Raciborski, Olivier D'Angers, M. Pouchet, make no mention of it—though they all enter into details.

Dr. Montgomery, Dr. Swan, and, I think, Dr. Patterson, speak not of it.

M. Flourens, and M. Velpeau, and Dr. Moreau, omit all allusion to the vitellary structure of the substance.

Bernhardt, who was assisted in the construction of his *Symbolæ ad ovi Mam. Hist. ante Prægnationem* by Dr. Valentin, and in which admired work is contained a complete deduction of the whole literature of the corpus luteum, alludes not to the idea.

Von Baer's celebrated letter, *de Ovi Mam. et Hominis Genesi*, says of the corpus luteum, at page 20, *Me judice, minime corpus novum est, sed stratum internum thecæ majus evolutum*,—which expresses, with sufficient clearness, the opinions set forth in the rest of his paragraph.

Dr. Bischoff, of Heidelberg formerly, now of Geissen, in his *Entwicklungsgeschichte der Saugthiere und des Menschen*, says, at page 33:

Wenn mann die erste entwicklung des gelben Körpers, unmittelbar nach austritt des eies, bei Thieren beobachtet hat, so kann mann darüber nicht in zweifel seyn, dass die bildung seiner masse von den innern fläche des Graafschens Bläschens ausgeht. Da sie nun hier die aus zellen gebildete *membrana granulosa* befindet, da sie zuerst als gelber Körper erkennbarre masse gleichfalls aus zellen besteht, so ist es wohl gewiss, dass von einer stärkeren entwicklung dieser zellen der *membrana granulosa*, die ich auch in der Periphærie des eies noch nachweisen werde, die bildung des gelben Körpers ausgeht.

From this passage, it seems that Dr. Bischoff is not far from discovering what I suppose myself to have discovered; I mean the vitellary nature of the yellow body of the ovary.

It appears needless to make any farther citation in this place.

I shall here offer the remark, that if the concave superficies of the ovisac or inner concentric, is really charged with the office of producing or excreting the vitellary matter of the ovulum, which must be admitted, even if we allow to that body the metabolic or plastic cell-force, (for it must, at least, be the producer of the cytoblastem of the cell,) there is no very great difficulty in admitting that the convex or exterior superficies of the membrane may exercise the same functions as a dominant of the elective affinities, which must be supposed of every vital excrete.

And such a supposition finds abundant support in the analogy of the organs; as in the periosteal and medullary membranes of bones, for example; which, under certain circumstances, are known to alternate their functional force; the medullary membrane coming to be a depositer of phosphate of lime, instead of a remover; and the periosteum a remover, instead of being a depositer of phosphate, which is its normal office. This mutation of powers, as to the membranes of bone, has so clearly been described by M. Flourens, in his admirable paper on the production of bone and teeth, in the *Annales du Museum*, that it needs no comment.

But I am far from claiming this illustration for my view of the case; strong as I might deem it to be. It suffices for me to know, that vitellary matter is germinal matter, germinal cytoblastem; and that the business of an ovary is to produce it, which nothing else in nature can do.

As to the microscopic results at which I have arrived, I have nothing more to do than present them to the micrographers; and I should feel most happy if these remarks, meeting the eyes of Dr. Bischoff, or my kind friend, Dr. Pouchet, those gentlemen should deem them worthy of their attention, and confirmation or refutation. If they prove to be unfounded, I wish them to be confuted by better observers than I am.

As to some other points of resemblance, I have now to observe, that boiled corpus luteum becomes hardened, like yelk boiled hard. It is, in like manner, friable and granular, leaving a yellow stain on paper, like the stain from boiled yelk.

Dr. Thomas Schwann found it evidently coagulated, granular, and friable, upon being boiled.

In order to ascertain its odour, I threw a portion of corpus luteum on a live coal;—it gave out a strong odour of roasted eggs.

Are the granules and corpuscles of the corpus luteum cytoblasts and cells?

I have not been able so clearly to make out their nuclei, as to speak positively—I suppose them to be so. But Schwann, himself, who in one place seems to regard the nucleus as a *sine qua non* in cell-life, says, at page 204, of that most admirable and extraordinary volume, the *Microscopische Untersuchungen*:

Die kernloser zellen, oder richtiger ausgedruckt, die zellen, in denen bisjetzt noch keine kerne beobachtet werden sind, kommen nur bei niederen pflanzen vor, und sind auch bei Thieren selten. And he cites, as examples of the non-nucleated cell, the young cells within the old cells of the chorda dorsalis, the cells of the yelk of the bird's egg, &c., &c.

Be the non-nucleated vesicle a cell or not, it is very certain that the milk corpuscle, and, probably, the chyle corpuscle, is of that nature,—and no one can contemplate the amazing reproductive power of a cell or spore of the *saccharomyces cerevisiæ*, without admitting for it all the properties of the cell-force. It is to the last degree reproductive, as are also many of the filiform fungi, the muscardine, &c.

The question, at last, is whether I have made a discovery interesting to the physiologist, the practitioner, and the jurisconsult.

If I am right in my opinions, it must be interesting.

As a *resumé*, I say that my views are based upon the facts that,—

1. Equal masses of yelk and corpus luteum are equally yellow.
2. They alike fill the tube, before the focus is got, with a brilliant, yellow light.
3. They alike consist of a pellucid fluid, in which float granules, corpuscles containing yellow fluid, oil-globules, and punctiform bodies.
4. These bodies, placed on the same platine, and diligently compared together, exhibit the same forms, size, tint, and refractive power.
5. Yelk, boiled hard, is granular and friable; it is coagulated by heat.
6. Corpus Luteum, boiled, becomes hard, granular, and friable—it is coagulated by heat.
7. Both substances, raw or boiled, stain paper alike of a yellow colour. This experiment was repeated after Bernhardt, who says, *Cujus pigmentum aurantiacum, (cor. lut.), admotis digitis adhærescebat.*—P. 39.
8. There is this difference:—The crushed mass of corpus luteum contains patches of laminar cellular tela, detritus, and blood discs, forced out by the compressorium; which cannot occur in the yelk, as it is contained in a vitellary membrane, in which its corpuscles are free; whereas, in the corpus luteum, they are confined by the delicate cellular substance betwixt the concentric laminæ of the Graafian follicle.
9. They refract alike.
10. Projected on a live coal, they alike give out the odour of roasted eggs.

While I, of course, derive this view from perception of my own senses only, I ought perhaps to take leave of it here, committing it to more capable observers, in order to know whether they perceive it as I do; such as Dr. Schwann, whose great and most esteemed politeness to me, last year, at Louvain, makes me hope he will examine it; as also, Dr. Pouchet, who has done so much, in his *Théorie Positive de la Fécondation des Mammifères*, to clear the track of the physiologist and the physician.

But, while I suppose that farther observations may probably confirm my views, I see no objection why I may not now offer some remarks, in the way of a rationale, upon the point in question, in this paper, the more particularly, as I hitherto rely only upon my own observations.

I therefore state, that all living beings are results of the operation of a reproductive or generative force.

This is true both as to plants and animals; with the *possible* exception of certain fissiparous and gemmiparous creatures, as well as of certain sporiferous fungi, and some creatures of a higher scale, as the nais proboscidea, &c. I say of these, that they constitute a *possible* exception to the law of reproduction by germs. I do not say they are exceptions.

This reproductive force has the same relation to the conservation of the vegetable and animal genera, as the force of attraction has to the conservation of the brute masses of matter of the universe.

For it is obvious, that, but for this force, all the genera would die out in a single generation, and yet it is apparent that nothing is more permanent than the genera, which extend from age to age, touching the beginning, the whole course, and the end of time.

All the existing genera are the same to-day as at the commencement of the present cosmic career, and are destined to be so until the next great cataclysm of the globe. M. Flourens, in his work on generation, makes use of the *mot*, the saying, *un être collectif*, a collective being—in speaking of the immutable permanence of a genus. This fine saying leads the mind at once to a view of the importance of the law of genesis by which so great an end is attained.

It would, perhaps, be superfluous to say that, but for the exercise of this force, all *morals* would be nullified, and blotted out of the great scheme of Providence; for, should the genera fail or die out, the earth would become a desert; no flowers to bloom, no corn, nor wine, nor oil—no insect, to sport in the sun-beam—no song of birds—no lowing of cattle—no voice of man to acknowledge, and praise, and give thanks to the Giver of every good and perfect gift. Thus the whole scheme of morals would cease and be terminated, leaving no witness here to the power of God, beyond the senseless play of the elective and gravitating attractions.

Is it not clear, then, that the laws of this great conservative force must be most important laws? Can such great forces have little or no concern with the regulation and co-ordination of the other life forces? I repeat, that for life they have the same importance as appertains to the laws of attraction for the physical bodies of the globe.

This force is the true development force, not only for the germ, but for the embryo, the foetus, the child, the youth, and the man. He who shall know it truly, shall know the laws of life.

It is not only a generative, but a generic force. It determines the genera in an endless succession of ages. No horrid passion, no wild lust, no insane desire can contravene the irreversible law of the distinction of the species and genera—"each after its own kind,"—which, but for its provisions, would rush into chaotic confusion and mixture—whereas they are, in truth, trenchantly divided, and set apart, and maintained for ever, pure and unmixed.

This force—this amazing force, is concentrated and summed up in a special animal or vegetable tissue. Nothing in animals, save a vitelliferous tissue can yield or give out this force. It is the endowment of an ovarian stroma, as it is called, by Von Baer. It is the peculiar life-property of that concrete, and of nothing else.

The stroma (Lager,) of ovaries, is a tissue developed and sustained by the combined agency of a spermatic or ovarian artery, and a spermatic nerve.

The spermatic nerve possesses an intimate plexus and ganglionic relation to the spinal, the sympathetic, and the splanchnic systems of innervation—so that it is related, in fact, to all the organisms.

Under the dominant indicative influence of the spermatic nerve, the ovaric artery, by its branches and termini, deposits the materials of the concrete of the stroma, with all its parts and mechanism.

The general relations of the ovary with the whole of the innervations, while it enables it largely to influence them all, renders it liable to disturbance by their derangements. Its great influence is exhibited in pronouncing the single word sex, for the ovary is the

sex of the woman, or the female. But if the ovary be her sex, then the whole physical, moral, and intellectual character of the female are derived from it, as their source and dominant—they are conformed to its wants, its powers, its offices, and modified often by its conditions.

The materials of development for all the organs are derived from the blood, which may, without violent misapplication of the metaphor, be said to exist in a multilocular cyst, of which the cellulæ are the different sanguiferous tubes and cavities of the vascular system. It is every where the same, and presents in each of the organs the same liquor sanguinis, and discs—so that although all development is at the expense of the blood, yet there is another, and esoteric force, to compel the elective attractions by which every living concrete is produced.

The physiologist knows that this esoteric force is nerve force—and he will not deny that, for the development of both a general and special anatomic structure, it must possess what I desire to characterize as a generic force, else all development would be in spherical forms, and of the same constituent elements.

No power can so modify the generic force of the nerves and blood vessels of the cephalic extremity of the inchoate embryo as to protrude from it a pelvis or a foot. Nor could a leg be possibly developed in the place of a prehensile limb. Even in the quadrimana the law holds good.

A liver whose development depends on its nutritious artery and its nerves, could by no means be formed at the caudal or cephalic pole of a mammal. It must always have its central position. No examples will be found of a lung placed below the diaphragm. Hence, I say, the law of generic development is a law applicable not to the creature only as a whole, but to each of its several constituent parts. The whole business of zoological classification depends upon this order.

This law not only operates during the embryonal, the foetal and the puberic development, but is in force throughout the whole duration of life, perpetually repairing the organs, and maintaining their *generic* force, against the waste and detritus of life, until the cessation of life.

The membrana germinativa of the ovum, which is probably R. Wagner's macula, (Keim fleck,) is an elliptical or circular disc. No power could determine the production of the pelvic at the cephalic, or the cephalic at the pelvic segment; nor a leg from the thoracic, or of an arm from the iliac region of the disc. Hence it is true to say, that such disc is endowed at different parts of it with a generic force, operative only in that one sole direction. I say generic, since the idea is applicable to all animals whatever.

My motive for making the foregoing remarks was, that they might serve as an induction or basis, on the generic force of *ovaries*.

An ovary is developed by an ovaric trunk and its branches, drawing the vital current from the aorta or the emulgent, and attended by the spermatic nerve, which I regard as a reproductive nerve, and generic in its powers.

I say a reproductive nerve, since its innervation is devoted to the evolution of germs. No other nerve has such a mission: I say germs—or germ cytotblastem.

If Huschke's pretty idea should prove to be well founded, I see no escape from the attribution of this reproductive quality to the spermatic nerve. Huschke supposes that each Graafian follicle is a cast-off acinus of the stroma, carrying away in its fall an endowment of vital force rendered complete by fœcundation.

But, without discussing the question of the aciniferous nature of the stroma, the same attribution of the nerve power is true, even under the hypothesis of an independent cell-life—for a reproductive cell could not exist but for the vitellary cytoblastem provided by the stroma, which is a vitelliferous tissue, and only that. Nothing else is so. The nature of the cytoblastem must determine the differences of cells. The cell of an oak germ is not the cell of a cabbage germ.

But the whole office of an ovary is to produce or prepare germs—it is germiferous; and it is so by its power to form vitellary matter. No other combination or arrangement of animal materials can produce yelk or vitellus.

The complete germ is contained within a vitellary membrane—which is the boundary of the yelk. In the mammals this yelk is microscopic. In the ostrich and the cassowary it is a very large ball, as it is in some of the larger ophidians, as in the coluber boæformis, &c.

The matured germ contained within a yelk is spontaneously and periodically extruded from the ovary, in order that it may be fairly exposed to the contact of the male fœcundative element—which should be deemed impossible while it is buried within the recesses of the ovarium, covered by the double tunic of the follicle, and beneath both the fibrous and peritoneal indusium of the organ.

To effect this extrusion, this spontaneous oviposit, the inner concentric spherule of the follicle is compressed, by the deposition on its external convex surface, of yelk grains, corpuscles, oil-globules, punctiform bodies, and pellucid fluid—which gives to the concave surface of the cell an appearance of corrugations or convolutions like those of the brain, and which, as they daily increase by the continued deposit of yelk matter on the exterior, constantly reduces the size of the interior dimensions of the follicle, urging its contents towards the least resisting point of the surface of the ovary, until, at length the *porule* being opened, the ovulum escapes into the fimbria, or falls with the peritoneal sac, according to circumstances.

After the escape of the ovulum, the yelk-producing force is not exhausted immediately, in all cases; hence the growth of the corpus luteum continues.

It is a periodical exacerbation that matures and bursts the Graafian cell. When the process of completing a germ and expelling it has been finished, the exacerbation ceases sooner or later, and a new periodical exacerbation of this strange life force—or germ-producing force—is devoted to the maturation and spontaneous oviposit of another ovulum, and so on in succession, during the menstruating life of the woman; at every successive pairing season of birds; and at the annual rutting time of the more considerable mammals, and with all the migratory fishes.

It surprises me to see that many able and distinguished writers still cling to the antiquated notions as to the ovaric fœcundation, which M. Pouchet has shown to be an

impossibility. It appears to me that my view of the vitellary composition of the corpus luteum, and the mechanical result of its accumulation in effecting the oviposit ought to be received as satisfactory rationale of the germ-depositing function. The fœcundation of germs is a mystery which I deem beyond human cognition—and likely ever to remain so. The inquiry into the corpus luteum is far more feasible and practicable. No woman can menstruate but coincidently with, and in consequence of, the oviposit. Every oviposit is followed by a corpus luteum, which is larger or smaller, according to circumstances. Many women have scarce discernible ones after conception—others have very large ones. The true and false corpora lutea differ only in magnitude—not in their essential nature.